



## Prevalence of untreated hip dislocation in Turkish children aged 6 months to 14 years

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**Objective:** In this study, our aim was to determine the prevalence of untreated hip dislocation and subluxation in Turkey.

**Methods:** Pelvic radiographs of 4,947 children, aged between 6 months and 14 years, taken for non-orthopedic purposes were requested from 23 provinces around the country. 3,723 radiographs met the study criteria and were evaluated. Dislocated and subluxated hips were identified according to the relationship of femoral head using Perkin's line and quadrants.

**Results:** Thirty-five hips in 22 children were found to be dislocated or subluxated. The prevalence rate was calculated as 5.9%.

**Conclusion:** Despite appearing to have decreased when compared to limited regional prevalence studies, hip dislocation and subluxation prevalence is still unacceptably high. More extensive work should be done to avoid external factors in the etiology of developmental dysplasia of the hip and to organize screening programs in newborns.

**Key words:** Developmental hip dysplasia; epidemiology; prevalence.

Developmental dysplasia of the hip (DDH) is a disorder that results in disability, if not diagnosed or treated early. It has been estimated that 8 to 29% of all hip arthroplasties are performed to treat osteoarthritis secondary to hip dysplasia.<sup>[1,2]</sup> Several types of screening methods have been described for early diagnosis which is the cornerstone of successful treatment. Studies regarding the incidence of DDH in Turkey have been primarily neonatal screening studies consisting of clinical examination and ultrasonographic evaluation.<sup>[3-8]</sup> Previous studies comparing clinical examination to ultrasonographic evaluation reported a rate of misdiagnosis with clinical examination alone of up to 60%.<sup>[3,9]</sup>

There are few reports regarding the prevalence of delayed DDH diagnosis in Turkey. Two studies reported prevalence rates of 13.4% and 15.7%.<sup>[10,11]</sup> Both studies were cross-sectional studies representing only two neighboring areas (Ankara, Konya). A study representing the whole country has not yet been performed. There is a need to determine the prevalence rate of non-treated or overlooked hip dysplasia consisting of dislocations and subluxations in Turkey. For this purpose, we performed this study to determine the prevalence of non-treated hip dysplasia in Turkey with support from the Turkish Society of Orthopaedics and Traumatology (TOT-BID).

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**Submitted:** March 4, 2011 **Accepted:** June 6, 2011

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## Patients and methods

This study was performed with the support of the TOTBID Board of Directors, upon the request of our research group. We investigated the rate of hip subluxations or dislocations on pelvic radiographs images taken for non-orthopedic purposes (urologic, gastrointestinal, trauma, scout images of abdominal CT... etc.). Children with a radiologically visible femoral head and an open triradiate cartilage were included in the study. A nationwide data profile was defined according to the The Nomenclature of Territorial Units for Statistics (NUTS) system, published by the National Statistics Institute. Sample size calculations were accomplished with NCSS PASS 2007 software. Based on previous prevalence studies, the expected rate of dislocation was assumed to be 1.4% and the maximum prevalence was accepted as 1.9%. Type 1 error (alpha) and power was accepted as 0.05 and 0.90, respectively. A total of 6,737 children 14 years and younger in 12 NUTS areas were found. With the approval of TOTBID, a proportionate number of radiographs were requested from hospitals in the determined cities.

Radiographs from twenty-three cities in seven districts were collected. Low quality images; radiographs taken for orthopedic purposes; cases in which the femoral head was not ossified or the triradiate cartilage was fused; and teratologic cases, such as cerebral palsy, myelomeningocele extrophia and other anterior abdominal wall defects were not included in the study. Remaining radiographs were evaluated for pelvic tilt according to the obturator foramen vertical height / symphysis pubis upper border – Hilgenreiner height ratio (N:1.2-0.75) described by Ball and Kommenda, and for rotation according to ratio of lengths of both obturator foramina (R/L:1.8-0.56) described by Tönnis and Brunken. Excessively tilted (outlet-inlet) or rotated radiographs were excluded.<sup>[12]</sup> Measurements were made using a MB-Ruler 4.0 in digital radiographs and a regular ruler for printed radiographs. The dislocation and subluxation of hips were determined according to the location of femoral head epiphysis in relation to a quadrant formed by the Perkin's line and the Hilgenreiner line (Perkin-Ombredanne quadrant) and the status of the Shenton-Menard line (Figs. 1 and 2).<sup>[12]</sup>



Fig. 1. Subluxated hip.



Fig. 2. Dislocated hip.

## Results

A total of 4,947 radiographs were received from the requested cities. 1,226 radiographs were excluded according to the study criteria and 3,723 radiographs from 19 cities were accepted for evaluation. Analysis of data size revealed a power ratio of 0.73. City distribution and radiograph numbers are listed in Table 1. The distribution of patients according to age and sex is listed in Table 2.

Thirty-five hips in 22 children were found to be dislocated or subluxated (Figs. 3 and 4). Sixteen hips were subluxated and 19 hips were dislocated. The vast majority of subluxated and dislocated hips were found to be from the eastern part of the country (Table 3).

Female to male ratio in the dislocated or subluxated hips was 3.4 to 1. Bilateral involvement was observed in thirteen of twenty-two children (59%). The left to right ratio in unilateral cases was 2 to 1. Evaluation of the data resulted in an undiagnosed or unrecognized hip dysplasia rate of 5.9‰ (22 of 3,723). Attempts were made to contact patient relatives for notification, treatment and the follow-up of cases via TOTBID.

**Table 1.** Distribution of cities included in the study.

City	Number of cases	Percent
Ankara	167	4.5
Aydın	32	0.9
Bolu	93	2.5
Bursa	66	1.8
Erzurum	199	5.3
Eskişehir	90	2.4
İstanbul	932	25.0
İzmir	192	5.2
Kastamonu	87	2.3
K.Maraş	291	7.8
Manisa	764	20.5
Mersin	30	0.8
Samsun	171	4.6
Şanlıurfa	123	3.3
Şırnak	116	3.1
Tekirdağ	52	1.4
Trabzon	160	4.3
Van	87	2.3
Zonguldak	71	1.9
Total	3,723	100.0

## Discussion

The reduction maneuver, described by Ortolani in 1935, is a widely used screening test for the diagnosis of DDH in infants. In 1962, Barlow defined the “dislocatable hip”. After 1984, the introduction of the ultrasound in the diagnosis of DDH by Graf<sup>(13)</sup>

**Table 2.** Age and sex distribution of children included in the study.

Age	Boys		Girls	
	Number of cases	Percent	Number of cases	Percent
6 mo.-1 yr.	262	55.9	206	44.1
2 yrs.	220	52.9	196	47.1
3 yrs.	214	55.7	170	44.3
4 yrs.	178	57.6	131	42.4
5 yrs.	157	49.8	158	50.2
6 yrs.	160	51.9	148	48.1
7 yrs.	155	50.2	154	49.8
8 yrs.	146	51.8	136	48.2
9 yrs.	175	57.2	131	42.8
10 yrs.	144	58.1	104	41.9
11 yrs. and over	226	59.8	152	40.2
Total	2.037	(avg.) 54.7	1.686	(avg.) 45.3

**Table 3.** Origins of dislocation and subluxation cases.

City	Status	Age	Sex
Ankara	Left subluxation	5	F
Ankara	Bilateral subluxation	1	F
Bolu	Right subluxation	1	F
Erzurum	Bilateral dislocation	2	M
Erzurum	Bilateral dislocation	1	M
Erzurum	Bilateral dislocation	1	F
Eskişehir	Bilateral subluxation	4	M
İstanbul	Left dislocation	1	F
İstanbul	Left subluxation	1	F
K.Maraş	Bilateral subluxation	1	F
K.Maraş	Left subluxation	1	F
K.Maraş	Bilateral subluxation	1	F
K.Maraş	Bilateral dislocation	1	F
K.Maraş	Right dislocation	1	M
K.Maraş	Bilateral dislocation	2	F
Mersin	Right subluxation	3	M
Samsun	Bilateral dislocation	2	F
Samsun	Left dislocation	2	F
Samsun	Bilateral subluxation	10	F
Şırnak	Left dislocation	7	F
Urfa	Bilateral subluxation	1	F
Urfa	Bilateral dislocation	3	F

and Harcke,<sup>[14]</sup> made the early diagnosis of DDH cases, which had previously been undetectable by possible physical examination. Regarding DDH, Dimeglio stated that "Prevention is winning wars elegantly without bloodshed".<sup>[15,16]</sup> Three types of preventive healthcare are defined: Primary prevention is the prevention of the occurrence of a disease, secondary prevention is the early detection of the disease and tertiary prevention is the early treatment of a disease.

Experimental studies revealed that the splinting of knees of rats and kittens in extension causes hip dysplasia.<sup>[17,18]</sup> Flexor tonus of lower extremities is dominant over extensor tonus in newborns. As hips and knees are flexed, the hip spontaneously abducts under the weight of the lower extremities. Since this position is the position of treatment in hip dysplasia, most hips spontaneously recover, unless the position is disturbed. Barlow noticed a 60% spontaneous recovery rate at the end of the 1st post-partum week.<sup>[19]</sup> After the introduction of ultrasound in the diagnosis of DDH, the self recovery potential of DDH increased. Spontaneous recovery rates of 89.7-97% of immature or pathological ultrasonographic findings were reported at the end of the 1st month.<sup>[20-23]</sup>

Incorrect habits, such as the holding of neonate upside down, with the lower extremities in extension just after labor to induce crying; the swaddling of a baby with hips fully extended; and the shaking of babies upside down after a bath to avoid water aspiration may cause dysplastic development of a hip with a potential for normal development. The rate of births under the supervision of a healthcare provider in Turkey increased to 95% from 83%, between 2003 and 2009.<sup>[24]</sup> Therefore, the education of healthcare providers in dealing with labor and neonatal care and the informing of the public of maneuvers and positions that induce hip dysplasia are important measures for the primary prevention of DDH.<sup>[25]</sup> On the other hand, hips that do not have the potential for spontaneous healing should be diagnosed and treated as early as possible through nationwide screening protocols and programs.

Screening in DDH can be performed through the physical examination and follow-up of all neonates, the clinical examination and ultrasonographic follow-up examination of all neonates with risk factors or

positive findings in physical examination, and the ultrasonographic examination of all neonates regardless of risk factors. It has been reported that with physical examination alone, up to 60% of dysplasia cases remain undiagnosed, resulting in a tendency towards the ultrasonographic screening of all neonates.<sup>[3,7,9,26]</sup> Meta-analyses, systematic reviews and decision-analysis studies dealing with universal ultrasound screening, many of which report short-term results, have been performed. These studies state that with the current data, it is not yet possible to make definitive statement regarding universal ultrasound screening, due to insufficient evidence.<sup>[27-29]</sup> They also advise the routine physical examination of all neonates and through selective ultrasonography in cases with risk factors and physical examination findings to ensure a coxarthrosis free hip at age 60.<sup>[30]</sup> In Turkey, the ultrasonographic evaluation of all newborns is not possible. Therefore, physical examination and evaluation for risk factors (primiparity, breech presentation, positive family history, multiple pregnancies, oligohydramnios, and other intrauterine anomalies) of all neonates and the ultrasonographic examination of newborns with positive examination findings and risk factors are advisable.

The few studies dealing with the prevalence of hip dysplasia in Turkey reported similar results. Prevalence rates representing a single region (Ankara and Konya) were 15.7‰ in 1970<sup>[10]</sup> and 13.4‰ in 1992.<sup>[11]</sup> As each study was conducted in a single province, a nationwide generalization is not possible. Although our prevalence rate of 5.9‰ obtained from data collected from different parts of the country can be evaluated as a pronounced decrease, this rate still means the disability of 111 thousand children of the approximately 18 million 873 thousand children between 0 and 14 years of age.<sup>[31]</sup> Additionally, this rate represents only cases of dislocation and subluxation. Reduced hips with a high acetabular index were not included in this group. No studies in the literature have reported the late results of increased acetabular index, regardless of the spontaneous healing of these hips. Therefore, when data is evaluated according to age and acetabular index, a higher dysplasia rate can be expected. The concentration of pathologic cases in the eastern part of the country is another striking point.

A limitation of this study was that an estimated sample size could not be achieved, whereas a power of 0.73 was calculated. Another limitation was the lack of interpretation of inter-observer reliability and bias, due to evaluation of the radiographs by different observers.

In conclusion, we can state that the primary elimination of external factors by an increase in public awareness, the examination of all neonates by trained and experienced physicians, the documentation of risk factors and the ultrasonographic examination of those hips with positive findings and risk factors are recommended before the universal ultrasound evaluation of all neonates.

### Acknowledgements

Authors thank the following: Tayfun AÇIKGÖZ (Bursa), Rahmi Can AYGÜN (Konya), Ömer Lütfü AYTAÇ (Tekirdağ), Ozan BEYTEMÜR (Şırnak), Tefik Fikret BİLGİN (Antalya), Işıl ÇELEBİLER (İzmir), Ali DOĞAN (Van), Nurzat ELMALI (Malatya), Abdullah EREN (İstanbul), Serap ERGÖR (Manisa), Emel GÖNEN (Ankara), M. Akif GÜLEÇ (İstanbul), Burak GÜNAYDIN (İstanbul), Melih GÜVEN (Bolu), Erdem Uğur ISIKAN (Şanlıurfa), Orhan KARSAN (Erzurum), Servet KERİMOĞLU (Trabzon), Nusret KÖSE (Eskişehir), Sefa MÜEZ-ZİNOĞLU (Kocaeli), İsa Türkay ÖZÇELEBİ (Bilecik), Gürkan ÖZKOÇ (Adana), Volkan ÖZTUNA (Mersin), Bartu SARISÖZEN (Bursa), Fatih SÜRRENKÖK (İzmir), Emre TOĞRUL (Adana), Yılmaz TOMAK (Samsun), Egemen TURHAN (Zonguldak), Murat ÜZEL (Kahramanmaraş), Ahmet Nedim YANAT (Hatay), and Cem YÜCEL (Kastamonu) for their cooperation in providing the radiographs nationwide.

**Conflicts of Interest:** No conflicts declared.

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